

with motion, gravitation, inertia and energy, all units measurements and numerical examples being expressed in the metric system. Following these are sections treating of the elementary phenomena of heat, light and electricity. Magnetism, however, strangely enough, appears to have been entirely neglected, but no statement is made in explanation of this somewhat unusual omission. The arrangement and style of both text and illustrations are very good, the only objectionable feature being the ambiguity of a few of the mathematical signs, this being probably explained by the statement of the author that French types were used in this book. Some 240 illustrations add considerably to the utility of the volume.

Part iii., "Practical Chemistry," presents, in the form of a number of described experiments, the mode of preparation and properties of the more common elements and simple compounds. In addition to the actual descriptions of these bodies, much correlative matter is also included as to their distribution and economic use. A noticeable omission, from the reader's point of view, is the fact that no equations representing the preparations and reactions of the various substances are given in the text. A collection of equations is, however, given in an appendix at the end of the volume, but it is specially mentioned that the matter contained in this appendix is beyond the scope of the examination. Seeing that this is the third year of the pupil's training, and considering the important manner in which chemical equations enable a student to more easily understand the nature of a reaction by showing at a glance how the several constituents of a mixture arrange themselves, it is difficult to agree with such an omission. The experiments themselves are well chosen, and are usefully illustrated by numerous cuts of the apparatus in position. Each substance is discussed under the headings:—(1) Preparation; (2) Physical properties; (3) Chemical properties; (4) Occurrence and Uses.

L'Échappement dans les Machines à vapeur. By G. Leloutre. Pp. 156. (Paris: Gauthier-Villars. Masson and Co., 1900.)

Produits aromatiques; artificiels et naturels. By Dr. G. F. Jaubert. Pp. 169. (Same publishers.)

THESE two volumes are the latest additions to the comprehensive series published as the Encyclopédie scientifique des Aide-Mémoire. M. Leloutre has for many years carried on experimental and analytical researches upon steam engines, with particular reference to the condition of the steam in a cylinder during compression and exhaustion, and under different conditions. In the present volume he extends the results arrived at in his "Théorie générale de la machine à vapeur," and adds to his fundamental equations for the analysis of the trial of a steam engine a sixth term depending upon the condition of the steam in the cylinder at the end of the exhaust.

The natural and artificial aromatic substances at present known are tabulated by Dr. Jaubert. They are arranged in five classes, namely, aromatic alcohols; aromatic acids; terpenes; camphors; alcohols, aldehydes and terpene acids. A short description is given of the characteristics of each class, and following it are tables showing the commercial name, scientific name, empirical and constitutional formulæ, method of preparation, references to literature, properties and characteristic reactions. The study of these compounds is now the most important branch of organic chemistry, not only from the point of view of pure science, but also on account of their commercial value. The book should therefore be found of service to both chemists and pharmacists, as a convenient work of reference.

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Grundzuge der geographisch-morphologischen Methode der Pflanzensystematik. By Dr. R. von Wettstein. Pp. 64. Mit 7 lith. Karten und 4 Abbildungen im text. (Jena: Gustav Fischer, 1898.)

THIS suggestive little work, coming as it does from the pen of Prof. von Wettstein, will be read with attention by all who are interested in the wider problems of systematic botany. The author contends that a separation of species or sub-species on morphological grounds alone is unsatisfactory, and he reminds his readers that the appreciation of differences by this method must be ultimately a purely subjective one, and that the conclusions arrived at are liable to be vitiated on several grounds. Von Wettstein pleads for a more general recognition of the geographical areas occupied by species, and considers that a careful study of these will eliminate errors due to modifications depending on climatical or other physical conditions; and it is well known how efficient these are in producing races which, though retaining a general resemblance to a common ancestor, may yet be greatly dissimilar amongst themselves.

He applies his methods to a study of the Endotricha-series of Gentians, and thus comes to reduce the twenty-two species to six ground-forms or genuine species.

He further discusses some of the Euphrasias, and arrives at a corresponding result. It may, however, be urged that this method also is open to objection, and that more is to be got out of the study of species by experimental cultivation—an arduous task, but one which will perhaps yield more fruitful results than even the application of the geographical-morphological method.

Dreams of a Spirit-Seer, illustrated by Dreams of Metaphysics. By Immanuel Kant. Translated by E. F. Goerwitz, and edited with an introduction and notes by Frank Sewall. Pp. xiv + 162. (London: Swan, Sonnenschein and Co., Ltd., 1900.)

THE chief object in publishing this translation of Kant's "Traüme," which first appeared in 1766, is to show the relation between the philosophy of Kant and the teachings of Swedenborg. Students of metaphysics and psychology will appreciate this aid to a study of Kant's philosophical development.

LETTERS TO THE EDITOR.

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On the Process of Dyeing with Woad Alone.

IN my paper in NATURE (February 1, 1900, p. 331) on the blue colour in woad, no account is given of the method by which prepared woad can be used for dyeing wool blue. Some of my friends have suggested that the above-named communication was, in consequence, like the play of Hamlet with the Prince of Denmark left out. The request for information then made as to the *modus operandi* of the mediæval dyers who used woad and woad alone for dyeing blue has up to the present yielded no response.

There exists a tendency to believe that by long-continued cultivation the woad now grown and prepared in this country has lost its power of dyeing blue, and is only of use in setting up fermentation in the indigo vat. It is, however, very improbable that plant like *Isatis tinctoria* should entirely lose so characteristic a property as that of indigo-formation. It was, however, possible that some variation in the details of its manufacture might have had this effect. That fresh woad still can be made to yield indigo was shown, and the process of extracting it given in detail, in the paper above referred to.

Prepared woad is a dark brown, earthy-looking paste having an ammoniacal odour, yielding a yellowish-brown solution to water, and looking as unlikely a source of a blue dye as could

well be imagined. A supply having been obtained from the Parson Drove Mill, a series of attempts were made in flasks and beakers to get the blue colour, but they all proved unsuccessful. It was then determined to experiment on a larger scale. Having secured the assistance of a colleague, Mr. C. G. Barrett, we started an eight gallon vat in a small barrel, in a steam laundry. The directions of Hellot were closely followed—woad, weld, bran, madder, lime and hot water were duly mixed, the vat carefully covered, and periodically stirred—the result being, not a little to my surprise, that at the end of twelve hours a skein of wool, after an hour's immersion in the filthy-looking liquor, turned a good "pastel blue" on exposure to the air. A number of experiments were then made on a smaller scale, which we found answered equally well, and proved that it is as easy to dye wool blue with our English woad to-day as it was 300 years ago; any housewife could do it now, if need be, as easily as then. It is simply a question of digesting the woad at a temperature of from 100° to 140° F. (40° to 60° C.) for a prolonged period. We found half a pound of woad (500 grammes) to a gallon (4 litres) of water quite enough to yield good results. The water should be poured on the woad nearly boiling, the vessel closely covered at first, and kept heated to the above temperature. This can very conveniently be done by placing it on the brickwork of a steam boiler. In from ten to twelve hours small bubbles will begin to appear on the surface of the liquor; a little recently slaked lime (6 or 7 grammes) should now be stirred in, one noticeable effect of which will be the generation of an ammoniacal odour. A small pattern of wool left in for an hour will become pale blue on exposure to the air. In the course of a few hours a gramme or so of bran will set the fermentation up again, which in its turn can be controlled by adding lime. In this way the process may be kept going on for several days.

The longer and more often the patterns are immersed the darker they become—at first pale blue, they will eventually become dark blue—almost black. The paler shades are apt to have a green tint, and it was "to kill the green" that the older books on dyeing recommend the addition of a small quantity of madder.

It must be remembered that the quantity of indigo in woad is but small, so that experiments with less than half a pound are not likely to be successful; the great point, however, is keeping the temperature about 100° to 120° F. for many hours.

Our ancestors had neither steam boilers nor thermometers, but they would be able to keep the contents of an earthen vessel "nicely warm," as judged by the hand, by placing it on the hearth, when the embers were kept alight all night, for in those times kindling a fire by flint and steel was always an undertaking.

My thanks are due to Mr. C. G. Barrett for his great help in conducting these experiments, and for the facilities he has afforded for carrying them out, as well as to Mr. Fitzalan Howard, Prof. Penzig, of Genoa, and Sir Thomas Wardle.

King's Lynn, March 31. CHARLES B. PLOWRIGHT.

Illogicality concerning Ghosts.

MR. HERBERT SPENCER, exposing the various inconsistencies that occur so frequently in the ghost-stories of the savage races, says:—"How illogicalities so extreme are possible, we shall the more easily see on recalling certain of our own illogicalities. Instance . . . that familiar absurdity fallen into by believers in ghosts, who, admitting that ghosts are seen clothed, admit, by implication, that coats have ghosts—an implication they had not perceived" ("The Principles of Sociology," 3rd edition, vol. i. p. 104). It seems interesting to note that the same opinion was expressed about nineteen centuries ago by the Chinese philosopher, Wang Chung (*circa*, 27-97 A.D.), whose sceptic remarks on the traditions of all manners, handed down to his time in the Middle Kingdom, form a celebrated work named "Lun Han" or "Balance of Discussions." In its twentieth book (fol. 14-15 in Miura's edition, Kyōto, 1748), he says:—"Since the beginning of the world, so vast has been the number of the deceased, that it enormously exceeds that of the whole present population. Therefore, should every one become a ghost after death, man is bound now to meet a ghost at each step on the road, and should he see ghosts in his dying moments, he ought to find not one or two singly, but several millions of them collectively filling the space. When a man dies by a weapon, his blood, the essence of his life, turns to what is termed *ignis-fatuus*, which has no resemblance to him, but gathering itself into an amorphous

mass, looks like the light of fire. It is the ghost of blood, and presents an aspect quite different from a live man's blood, and, as the essence of life has been separated from the man's body, it cannot resume his shape in life. If all ghosts be seen in the form of dead corpses, you have reason to suspect the dead to become the ghost. . . . And, equally, a disordered fellow might be true in seeing a ghost of his live friend visiting him. But how could he see a dead man in his shape of lifetime? . . . As warm ashes, even after the fire has gone out, can be made to produce it again, we may with some reason suggest the possibility of a dead man appearing in the same form as alive. When we know well, however, that a fire once extinguished can never burn anew, it is evident that a dead man can never become a ghost. And now, what is the ghost? All say it is the soul of a deceased. Then, even if it could be seen by man, it ought to appear stark naked and fully disrobed: for the clothes have no soul to cover the dead man's soul; while the latter has no material body to put on a material raiment. Soul is an outcome of blood and breath, which, though dependent on body during man's life, are the things distinct from it; hence it might be still well to suppose soul able to survive body as a ghost. But the clothes consist of nothing but threads, cotton, hemp and silk, which have all no intercurrence of blood and breath imparted by the wearer's body; nor do they possess any blood and breath of their own; so that even when they keep their form entirely, they are as soulless as a human corpse; and how then could they resume their former shape after their total decomposition? Thus, saying that a ghost appears clad necessitates the admission of its possession of body; which view itself militates against the definition of the ghost, because, according to this statement, the said ghost is a composite of the ghosts of body and clothes, which is essentially different from the soul of a deceased individual."

It is curious to observe that Wang Chung himself is quite illogical in esteeming it just to suppose a ghost able to appear only divested: for, according to his own proposition, the soul exists only in blood and breath; while the body, though very closely connected with them during life, is, after death, as severed from them as the ever lifeless and soulless clothes; so that, should it be necessary for a ghost to appear divested, it would be equally so to appear disembodied at the same time.

April 2.

KUMAGUSU MINAKATA.

Fertilisation of Flowers in New Zealand.

On p. 16 of your issue of November 2, 1899, reference is made to an article in the London *Quarterly Review*, by "A Field Naturalist," in which the writer expresses the opinion that "under natural and equal conditions, self-fertilisation of flowers is both the legitimate fertilisation and the most productive." I have not seen the article, but would like to place on record the following facts, which may be of interest to botanists in this connection.

I have cultivated most of the common flowers of the European and North Temperate region during the last thirty years, and have kept a pretty close record of their behaviour under the somewhat altered conditions in which they are placed in New Zealand. In this part of the colony the climatic conditions are not very dissimilar to those of the milder and moister parts of Britain, but the insects are, of course, totally different.

Previous to 1885, when humble-bees were first introduced into New Zealand, certain flowers, which were freely cultivated here, never produced seeds under natural conditions. But since the bees have become numerous and have spread over the colony, the conditions have quite changed. Primroses, cowslips, and the various hardy hybrid primulas all seed freely. So do pansies, crocuses (except the common yellow Dutch, which does not seem to be fertilised by the bees), Canterbury bells, antirrhinums, and many others which formerly never seeded. Now we find the plants in the spring-time surrounded by crowds of self-sown seedlings.

The bees were introduced, as is well known, by the Canterbury Acclimatisation Society, for the purpose of fertilising the flowers of the common red clover—*Trifolium pratense*. It was supposed at the time, that the insect which was introduced was *Bombus terrestris*, which, by the way, is unable to fertilise the flowers of red clover on account of the shortness of the trunk. As a matter of fact, some of the nests brought out to the colony were those of *B. terrestris*, but among them were also two varieties of *B. hortorum*, and it is this latter long-trunked species which is now so abundant, and fertilises so many of the introduced flowers.